WHAT IS CLAIMED IS:

1. A method of manufacturing an optical element, comprising the stages of:

machining a substrate;

removing a contamination from a surface of the substrate after the machining; and

removing a deterioration layer in the surface of the substrate after the machining.

2. A method according to claim 1, wherein the substrate is made of CaF2 single crystal.

3. A method according to claim 1, wherein the contamination removing stage includes the stage of focusing laser light on the surface of the substrate.

4. A method according to claim 3, wherein the laser light is KrF excimer laser light.

5. A method according to claim 1, wherein the deterioration layer removing stage includes a step of ultrasonic-washing the surface of the substrate with an aqueous wash solution.

6. A method according to claim 5, wherein in the ultrasonic washing step, ultrasonic washing with a wash solution containing a surface-active agent and

ultrasonic washing with pure water are performed in succession.

7. A method according to claim 6, wherein the deterioration layer removing stage further includes a step of rinsing the substrate with pure water and a step of drying the rinsed substrate after the surface of the substrate is ultrasonic-washed with pure water.

8. A method according to claim 1, wherein the contamination removing stage includes the steps of:

immersing the substrate in acetone;

taking out the substrate from the acetone and then wiping the surface thereof with a paper containing diamond powder;

processing the wiped surface of the substrate with solvent; and

processing the surface-processed substrate with UV/O3.

9. A method according to claim 8, wherein the solvent is ether.

10. A method according to claim 6, wherein the surface-active agent is an alkalescent surface-active agent.

11. A method according to claim 7, wherein the drying step is performed with a warm air.

12. A method according to claim 1, wherein the machining stage includes a step of cutting the substrate from a CaF2 single crystalline base substrate and polishing the surface of the cut substrate with a predetermined surface shape.

13. A method according to claim 12, wherein the machining stage includes a step of forming a protective film on the polished surface of the substrate, and the contamination removing stage is performed after the protective film is removed from the surface of the substrate.

14. A method according to claim 1, wherein the contamination is one of abrasive, oil content, and other foreign matter.

15. A method according to claim 1, wherein a surface roughness of the optical element is 0.5 to 0.55 nm by an examination with an RMS.

16. A method according to claim 1, wherein the optical element is one of a lens, a prism, a transparent plate, and a transparent rod.

17. A method of manufacturing an optical element, comprising the steps of:

machining a substrate; and

removing a deterioration layer in the surface of the substrate after the machining.

18. An exposure apparatus comprising:

an optical system having an optical element manufactured by the manufacturing method according to any one of claims 1 to 17, for illuminating a wafer with laser light having a wavelength of 200 nm or less.

19. A device manufacturing method comprising the stages of: exposing the wafer by the exposure apparatus according to claim 18; and developing the exposed wafer.

20. An optical element washing machine including an optical element holding unit, an excimer laser unit, and a focal control unit for focusing excimer laser light from the excimer laser unit, the optical element holding unit having a holder, a rotation stage, and a three dimensional control stage,

in which the holder is means for holding an optical element,

the rotation stage is means for rotating the holder,

the three dimensional control stage is a constitution element of position control means for causing the rotation stage to move in a vertical direction and/or a horizontal direction,

the excimer laser unit is a light source for emitting ultraviolet radiation, and

the focal control unit has basic control value setting means for setting a basic control value for a focal matching state of the ultraviolet radiation from the excimer laser unit, focal matching determination means for determining a focal matching state of the excimer laser light, and correction means for sending a correction amount corresponding to a determination result of the focal matching determination means to the position control means.